Art. IX.—*Contributions to the Palæontology of the Upper Silurian Rocks of Victoria, based on Specimens in the Collections of Mr. George Sweet. Part I.*

By W. S. Dun.

(Plate III.)

[Read 11th March, 1897.]

Some little time ago Mr. George Sweet of Brunswick, Victoria, placed in the hands of Mr. R. Etheridge, Junr., a collection of Victorian Silurian Fossils for determination. Shortly after this Mr. Etheridge was appointed to the position of Curator of the Australian Museum, and, being unable to devote the necessary time to this work, he suggested that I should take it up, with which suggestion Mr. Sweet generously agreed. The first part of this work is now ready, consisting of the descriptions of the corals contained in limestones and shales in the Mansfield and Kilmore districts. As a rule these forms are imperfectly preserved as shale casts, especially is this the case in the specimens from Kilmore, some of the Mansfield specimens being in a more determinable condition in limestone.

The forms contained in the collection are :—

Favosites gothlandica, Lamarck.
Pleurodictyum, sp.
Cyathophyllum elegantulum, n.sp.
Cyathophyllum Mansfieldense, n.sp.
Petraia, sp.
Monotrypa, sp.

Though this fauna is small, still it is sufficiently definite to determine the beds as of Upper Silurian age. The ranges of the different species and genera will be found mentioned later on.

The descriptions and records of Palæozoic Corals in Victoria are very scanty, there being descriptions of two forms only, *Favosites goldfussi*, D'Orb., from the beds classed as Middle

Devonian, Buchan, by Sir Frederick McCoy[1] and *Favosites grandipora*, Eth. fil., by Mr. R. Etheridge, Junr., from the Lilydale Limestone.[2] Sir Frederick records *F. goldfussi* also from Cooper's Creek, Thompson River,[3] associated with corals of species allied to *Cyathophyllum cæspitosum*, *Trematopora ostiolata*, Hall, and *Cladopora fibrosa*, Hall, and the same species of *Trematopora* from Deep Creek, on the Thompson River. *Favosites fibrosa*, Goldfuss, is recorded from Upper Silurian rocks at Jamieson,[4] and also from an Upper Silurian sandstone ridge between Whroo and Coy's Diggings.[5] *Heliolites interstinctus*, Linn., has been collected from Upper Silurian beds at Waratah Bay,[6] and also from a locality five miles E.N.E. of Redcastle.[7] *Pleurodictyum megastomum*, McCoy (M.S.), a form with which our *Pleurodictyum* sp. probably is identical, is mentioned in Sir Frederick's Essay on the Natural History of Victoria as occurring in the Upper Yarra District.[8] This form is also quoted by Roemer.[9] *Stromatopora concentrica*, Goldfuss, is mentioned as occurring in the Devonian limestones of Bindi.[10] Mr. Etheridge also records the occurrence of three distinct species of *Stromatopora* from the Wenlock (Upper Silurian) limestone of Lilydale.[11] From the same locality Mr. Cresswell notes *Heliolites*, sp., and *Cyathophyllum*, sp.[12] Sir Frederick McCoy also mentions[13] the occurrence of new species of fossil corals at Waratah Bay, but gives no clue as to what they are. Species of Petraia have also been recorded from Kal Kal[14] and Kilmore[15] by McCoy.

Judging from the meagre collections that have hitherto been made it would appear that the Palæozoic coral fauna was not so well developed in Victoria as in New South Wales and Queensland, but as so many of the limestones and associated shales appear to be favourable to the preservation of their remains, it is probable that systematic collecting will add more forms. It seems strange that in Mr. Sweet's large collections from Kilmore and Mansfield there are no traces of *Heliolites* and so few specimens of other forms.

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[1] Prod. Pal. Vict., 1876, Dec. 4, p 15, t. 35, f. 1.

[2] Records Austr. Mus., 1890, i., p. 61, t. 8, f. 6-9.

[3] Prog. Rept. Geol. Survey Vict., 1878, p. 175.

[4] *Op. cit.*, 1877, p. 157.

[5] *Op. cit.*, 1878, p. 174.

[6] *Op. cit.*, 1877, pp. 156, 158.

[7] *Op. cit.*, p. 158.

[8] Ann. Mag. Nat. Hist., 1867, xx., p. 201.

[9] Lethæa Geognostica, 1883, i., Lief. 2, p. .

[10] Prog. Rept. Geol. Survey Vict., 1877, p. 158.

[11] Records Austr. Mus., 1890, i., p. 60.

[12] Proc. R. Soc. Vict., 1893, v. (N.S.), p. 41.

[13] Ann. Rept. Dept. Mines Vict. for 1894 [1895], p. 18.

[14] Geol. Survey Vict., Quarter-sheet 3 S.W.

[15] Geol. Survey Vict., Quarter-sheet 4 N.W.

In the preparation of these notes I have often availed myself of Mr. R. Etheridge's wide experience among Palæozoic corals.

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Class—Actinozoa.
Order—Zoantharia.
Sub-Order—Z. Sclerodermata.
Section—Perforata.
Family—Favositidæ.
Genus—Favosites, Lamarck, 1816.
(Histoire Anim. sans Vert., ii,, p. 204.)

Favosites gothlandica, Lamarck.

(For general synonymy see Nicholson, Tabulate Corals, 1879, p. 46; for references to records of occurrences of this species and of its variety *F. goldfussi*, D'Orb., in Australia, see R. Etheridge, Junr., Catalogue of Australian Fossils, 1878, pp. 12, 36.

Favosites gothlandica, Nicholson and Etheridge, Ann. Mag. Nat. Hist., 1879, iv., p. 209. R. M. Johnston, Geol. Tasmania, 1888, t., ii., f. 14. R. Etheridge, Junr., Geol. and Pal. Queensland, 1892, p. 50, t. iii., f. 1-5.

In the collection there are several specimens of *Favosites* which can safely be referred to this cosmopolitan species, the size of the corallites, the arrangement of the tabulæ, and the general appearance being similar to those characteristics as developed in this protean form. I group together under this head two forms, in one of which the corallites are larger than in the other, but taking into consideration Professor Nicholson's remarks[1] on this subject and allowing for the fact that in neither case are the mural pores visible, nothing would be gained by their separation.

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[1] Tabulate Corals, pp. 46-56.

Some of the specimens have strongly concave and slightly irregular tabulæ. For the same reason it would be perhaps better to consider Sir Frederick McCoy's *F. goldfussi*,[1] as he himself remarks, as a synonym of *F. gothlandica*, as Nicholson has done in the case of European specimens. The latter author remarks:[2] 'As has been previously said, *F. gothlandica* was regarded by Milne-Edwards and Haime as essentially a Silurian species, and the corresponding Devonian forms were separated by them under the name of *F. Goldfussi.* This latter species is separated by its authors from *F. gothlandica* simply upon the ground that its corallites are said to be larger, and that the mural pores are more closely set than in the Silurian form. The size of the tubes (one and a half line) is, however, frequently exceeded by typical Upper Silurian examples of *F. gothlandica*, and under any circumstances cannot be regarded as a character of the smallest specific value, while the mural pores exhibit at least an equal variability. I am, therefore, quite unable to accept the separation of *F. Goldfussi* from *F. gothlandica*."

There can be no benefit derived from classing the forms in different species according to the Australasian horizons they come from, as the variations are as great here as in the Old World. It would, I think, therefore, be better to consider all forms coming under the wide specific range allowed by Nicholson as Australian representatives of *F. gothlandica*.

The species occurs in Victoria in rocks classed as Upper Silurian and Devonian. In Queensland the limestone of the Broken River (Burdekin), which has been classed by Messrs. Jack and Etheridge as Middle Devonian, and which may perhaps be correlated with the Siluro-Devonian Limestones of New South Wales, as has already been remarked by Mr. R. Etheridge, Junr. In New South Wales it is extremely common and variable and occurs in Upper Silurian, Siluro-Devonian, and the Moonbi Limestones which have been lately referred by Professor David to the Devonian.

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[1] Prod. Pal. Vict., 1876, Dec., iv., p. 15, t. 35, f. 1-1*d*.

[2] *Loc. cit.*, p. 54.

Genus—Pleurodictyum, Goldfuss, 1829.

(Petrefact. Germaniæ, i., p. 113).

Pleurodictyum, sp. (? **P. megastomum**, McCoy, M.S.)

(Pl. III., Fig. 1).

In the collection there are two specimens of casts of this coral from Kilmore and several from the Mansfield district. They occur solely as casts, and though there can be no doubt as to the generic position, it would be difficult to assign specific characters to them. The most perfect specimen is from Kilmore, and shows impressions of nine polygonal calices and a portion of a tenth. These form a more or less circular corallum. Extending across it there is an irregular depression, which may possibly represent the impression caused by the vermiform body, and would point to the fact that we have before us the basal portion of the corallum, especially as the corallites are radiating outwards. The cell walls have been dissolved away, and their position is shown by spaces traversed by bars representing the infilled mural pores, so that we have only an internal cast presented. The walls have been thick and the septa numerous and represented by broken ridges, pointing to the fact that the septa in the original condition were present as rows of spines rather than as regular ridges. The mural pores are large, irregularly spaced and numerous, as represented by the bars before mentioned. The tabulæ are slightly arched and not perfectly smooth. but covered with numbers of small pits representing in the original a slightly pustulose or spinous appearance. The largest tabula has a width of $\frac{13}{40}$ of an inch. The specimen from Kilmore showing the ten corallites has a diameter of $\frac{17}{20}$ of an inch.

From this short description it will be seen that there is very little to go on as far as specific delimination is concerned. Sir Frederick McCoy has recorded[1] a form as *Pleurodictyum megastomum* from the Upper Silurian of the Upper Yarra District, but so far as I am aware does not describe it. It is quite possible that our form and this are one and the same.

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[1] Ann. Mag. Nat. Hist., 1867, xx., p. 201.

As compared with European species, and taking first *P. zorgense*, Kayser,[1] from Sprakelsback in the Lower Devonian of the Harz, the corallites of our form appear to be larger, the mural pores more numerous and the septal spines more developed. Compared with *P. selcanum*, Siebel, as figured by Kayser,[2] the corallites are again much larger, but the nature of the septa differs radically and the pores are not so regular. From the well-known *P. problematicum*, Goldfuss, it is also separated by the difference of size of the corallites, the number of mural pores and the septal condition.

There is a very close connection between the genera *Pleurodictyum* and *Michelinia*, and it is possible, as pointed out by Professor H. Alleyne Nicholson, that these two genera will eventually be united. At present corals of this type occurring in Upper Silurian and Lower Devonian beds are referred to *Pleurodictyum*, whilst corals of a somewhat similar type occuring in higher Devonian and Carboniferous strata are classed under *Michelinia*. A very full discussion of the relations of these two genera will be found in Professor Nicholson's works,[3] and also in a paper by Professor Julien Fraipont.[4]

As regards the American forms it seems to approach nearest to *P. stylophorum*, Eaton,[5] from the Hamilton Group (Middle Devonian).

Taking all these facts into consideration, there seems to be no alternative but to class these specimens as *Pleurodictyum*, leaving the specific determination till more perfect specimens are available.

I have seen in the Upper Silurian (Wenlock) rocks of Yass, New South Wales, a *Pleurodictyum* having every appearance of the Victorian form, even as to preservation. Mr. John Mitchell has also recorded[6] the occurrence of *Pleurodictyum* in the Bowning Beds of the same district, associated with *Calymene Blumenbachii*,

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[1] Abhand. Geol. Specialkarte Preus. u. Thuring. Staat., 1878, ii., Heft 4, p. 229, t. 33, f. 9, 10.

[2] *Loc. cit.*, p. 227, t. 33, f. 8, 8A, ? 11.

[3] Tabulate Corals, pp. 141-143, 151, 152; Man. Pal., 1889, i., pp. 316-318.

[4] Sur les affinités des genres Favosites, Emmonsia, Pleurodictyum et Michelinia a l'occasion de la description d'une forme nouvelle de Favositide du calcaire carbonifère supérieur. Ann. Soc. Geol. Belge, 1888, xvi., p. 21-32, t. 1.

[5] Nicholson, *loc. cit.*, p. 145, t. 22, *c* and *d*.

[6] Proc. Linn. Soc. New South Wales, 1887, ii. (2), p. 412.

Acidaspis, *Cromus*, *Turrilepas*, etc. He says the "specimen has cells over half an inch in diameter, and the whole specimen measures two inches across," and surmises that it may be the same as Sir Frederick McCoy's *P. megastomum*. I have recorded[1] a species from near Fifield, New South Wales, and in the Mining and Geological Museum, Sydney, are specimens preserved in a ferruginous grit from Sebastopol showing very large corallites.

Pleurodictyum is usually considered to be a Devonian fossil, but it is possible, according to Nicholson's remarks, that many of the species of *Michelinia* described by Rominger from the Niagara (Upper Silurian) Beds of N. America, may be *Pleurodictyum*. The horizon of *P. zorgense* and *P. selcanum* is in beds which are considered by some to be Lower Devonian, though perhaps it would be better to consider them as passage beds—equivalents of those called by Dr. J. M. Clarke the Helderbergian of North America and the Hercynian of Europe.[2] So, though *Pleurodictyum* by itself may not be a very definite index of Upper Silurian age, still in its association with forms such as those occurring at Kilmore, Mansfield and Yass there is nothing anomalous.

Sub-Order—Zoantharia Perforata.
Group—Cyathophylloidea.
Family—Cyathophyllidæ.
Genus—Cyathophyllum, Goldfuss, 1826.
(Petrefacta Germaniæ, i., p. 54).

Cyathophyllum elegantulum, sp. nov.

(Pl. III., Figs. 5, 6).

Several fragments of an exceedingly elegant astræoid *Cyathophyllum* from Mansfield occur in the collection. This form is made up of corallites about one-eighth of an inch in maximum diameter, and five, six or seven sided, more commonly the latter.

There is no apparent difference in dimensions between the primary and secondary septa. The septa are slightly flexuous, twenty-four in number, and occupy about one-half the corallite, leaving a clear space in the centre, none running to the centre and commingling into a spurious columella as is so frequently the case in other species. The dissepiments occupy about two-thirds of the septate area, the in portion being composed of a row of convex vesicles, against which the tabulæ abut.

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[1] Ann. Rept. Dept. Mines and Agric. N.S. Wales for 1895 [1896], p. 189.

[2] The Hercynian Question. Report of the State Geologist, New York, for 1888 [1889], pp. 408-437.

The central clear space is traversed at regular well-marked intervals by well-developed convex tabulæ, about one-fortieth of an inch apart. The short interseptal loculi are traversed by the dissepiments for almost all their distance.

A well-marked character of this peculiar coral is its distinct biareal disposition as regards the septa. In the Cyathophyllidæ, according to Nicholson[1] (as typified by *Cyathophyllum*) "the septa are numerous, alternately long and short, the longer ones being continued to, or nearly to, the centre of the visceral chamber, where they are usually more or less twisted and give rise to a sort of spurious columella."

The correct generic classification of this form depends wholly upon the view taken of the validity of the non-extension of the septa to the centre of the visceral cavity being a specific rather than a generic character. In the Cyathophyllidæ it is not necessary that the septa should pass to the centre of the corallite, so that there appears to be no difficulty as to its family. The real difficulty is in its generic position—a first glance would suggest *Acervularia* as its resting place, with which it agrees in all points except the important one of the formation of a wall by the thickening of the septa around the inner tabulate area. Also in connection with *Acervularia*, Nicholson says,[2] that "the so-called *Acervulariæ* of the Devonian Rocks are nearly allied to *Cyathophyllum*," while the true *Acervularia* as typified by *A. ananas*, Linn., from the Upper Silurian of Gothland would be more correctly classed under the Astræidæ.

Weissermel has recently established a genus *Storthygophyllum*[3] to take in a coral from the Bordholm beds (Upper Silurian) of Esthland, characterised by alternate straight spine-like septa, free tabulate area, dissepiments vesicular and oblique. The author says: "The new species [*S. megalocystis*] is separated from *Pholidophyllum* and *Polyorophe* by the possession of dissepimental tissue and from all known genera with dissepiments and tabulæ by the rudimentary condition of the septa." In connection with Herr Weissermel's sections, it appears to me hard to reconcile his figures 6 and 7*a* with the descriptions of the one species, as in fig. 7*a* only dissepimental tissue is shown, whereas in the letterpress no mention is made of any part of the corallite being devoid of septa. It appears to me that apart from the difference of the arrangement of the dissepiments, the relative proportion of the central aseptate area and the condition of the tabulæ, most of which points seem to be of specific value only, there is very little difference between the Mansfield coral and *Storthygophyllum megalocystis*, Weiss. If the difference between the Victorian form and some of the described species of astræoid *Cyathophyllum* be considered to be mainly one of degree, the same would hold good for *Storthygophyllum*.

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[1] Manual of Palæontology, 1889, i., p. 286.

[2] *Loc. cit.*, p. 287.

[3] Zeits. Deutsche Geol. Gesell., 1894, xlvi., Heft 3, p. 619, t. 49, f. 6-7*a*.

I have referred to all descriptions of astræoid *Cyathophylla* at my disposal and can find none that approaches closely to this form. *C. bolonensis*, Edw. and Haime,[1] shows that the septa do not extend quite to the centre, though they are much more numerous and the dissepimental area is greater than in our form.

For the meantime I venture to class this form under the heading *Cyathophyllum*, adding to it the specific name of *elegantulum*.

Cyathophyllum mansfieldense, sp. nov.

(Pl. III., Figs. 3, 4).

Several examples of a simple turbinate *Cyathophyllum* occur embedded in limestone from Mansfield.

Septa fifty-two, reaching to the centre and intermingling, alternately long and short, but the difference in length between the two orders is not always very strongly marked, extending to well within the tabulate area. The fossula can only be faintly distinguished.

In the vertical section the dissepimental area is well marked and easily distinguished from the tabulate. The dissepiments occupy about one half the visceral cavity; they are small, vesicular and arranged obliquely downwards. The tabulæ are numerous, incomplete, and vesicular in disposition, those towards the centre of the calice being generally horizontal, whereas those next to the dissepimental area are oblique in arrangement. Primordial septa indistinctly seen in some cases; the septa are slightly thickened by stereoplasma.

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[1] British Pal. Corals, t. 52, f. 1*a*.

I do not think that this form can be confounded with any hitherto recorded from Australian rocks, or with any with which I am acquainted from foreign deposits.

From *C. sweeti*, Eth. fil.,[1] from Reid's Gap, Queensland, it may be readily distinguished by the general appearance of the septa, the less marked counter septum, and the absence of distinct twisting of septa at the centre. There are several undescribed forms from the Upper Silurian of Yass that approach closely to *C. mansfieldense*.

Family—Petraiadæ.

Genus—Petraia, Munster, 1839.

(Beitrage zur Petrefaktenkunde, i., p. 42.)

Petraia, sps. ind.

(Pl. III., Fig. 7, 8).

Under this heading are included some imperfect internal casts of rugose corals from Kilmore and Mansfield. These show the spaces occupied by short septa, longer at the base of the calycinal cup, and almost vanishing towards the mouth, and apparently alternately long and short. There is no trace of tabulate or dissepimental structure.

The genus *Petraia* includes corals characterised by the absence of tabulæ and dissepimental tissue and septa well-marked at the base of the calice, but represented by folds at the top. Some authors do not appear to recognise the validity of this genus, and though doubtless it has been abused, still of late years the general opinion appears to be changing, and some of the leading writers on Palæozoic Actinology give it due rank as a genus—Roemer,[2]

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[1] Procs. Linn. Soc., N. S. Wales, 1895, ix., p. 521, t. 40, f. 3, 4; t. 41, f. 1.

[2] Lethæa Geognostica, 1883, i., Lief. 2., p. 410.

Kunth,[1] Kayser,[2] Lindstrom,[3] Sherzer.[4] By others it has been considered generally as a synonym of *Cyathophyllum*.

Undescribed forms of *Petraia* are of pretty frequent occurrence in the Upper Silurian of the Yass district, New South Wales, which is considered to be of Wenlock age.

The range of this genus is from the Upper Silurian to the Carboniferous.

Order—Monticuliporidea.

Genus—Monticulipora, D'Orb., 1850.

(Prod. Pal., i., p. 25).

Sub-Genus—Monotrypa, Nicholson, 1879.

(Palæozoic Tabulate Corals, p. 320).

Monotrypa, sp. ind.

In the collection there are three specimens preserved in limestone from Mansfield, which, though unsatisfactory, prove the presence of Monticuliporoids in these beds, but the internal structure has been so destroyed by crystallisation that very few details can be made out under the microscope.

The corallites are small and irregular in size, prismatic, usually four, five or six sided, and form a massive and probably globose organism. The cell walls are thin and considerably thickened with sclerenchyma. No trace of mesopores or acanthopores can be seen, neither are monticules present in the specimens as preserved, though in connection with this last point it must be stated that it is doubtful that the true surface of the organism is preserved. The tabulæ are complete, far apart, thin, practically horizontal, and in adjoining tubes almost opposite.

There appears to be no differentiation of the corallites into larger and smaller.

From these few points this form would appear to come closer to Nicholson's *Monotrypa* than any other sub-division of *Monticulipora*. Though agreeing in many points with species recorded by this author[1] and Ulrich,[2] it does not appear to agree specifically with any of the forms described by them. It is to be hoped that more perfect specimens will be available for detailed examination.

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[1] Zeits. deutsche Geol. Gesell., 1870, xxii., p. 37-42.

[2] Abhand. Geol. Specialkarte Preussen, 1878, ii., p. 231.

[3] Bihang K. Sv. Vet. Akad., 1883, viii., 9, p. 12 (separate edition).

[4] American Geologist, 1891, vii., p. 278.

No specimens of Monticuliporoids have hitherto been described from Silurian or Devonian Rocks in Australia, though the genus *Stenopora* is very abundant in the Permo-Carboniferous rocks of New South Wales, Queensland and Tasmania.

The genus occurs in the Lower Silurian-Devonian of North America, and the Lower Devonian of Europe.

PLATE III.

Fig. 1. **Pleurodictyum** (? **megastomum**, McCoy, M.S.) Kilmore.

Fig. 2. **Pleurodictyum.** Mansfield.

Fig. 3. **Cyathophyllum mansfieldense,** Dun. Longitudinal section, x $\frac{3}{2}$. Mansfield.

Fig. 4. **Cyathophyllum mansfieldense.** Transverse section, x $\frac{3}{2}$. Mansfield.

Fig. 5. **Cyathophyllum elegantulum,** Dun. Transverse section, x 2. Mansfield.

Fig. 6. **Cyathophyllum elegantulum.** Longitudinal section, x 2. Mansfield.

Fig. 7. **Petraia,** sp. Kilmore.

Fig. 8. **Petraia,** sp. Mansfield.

Fig. 9. **Favosites gothlandica.** Portion of surface showing corallites. Natural size. Mansfield.

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[1] On the Structure and Affinities of the Genus Monticulipora, etc., 1881, pp. 102, 170.

[2] Geol. Survey Minnesota, 1895, iii., pt. i., p. 303.